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# Scientists and Soldiers Solve a Bee Mystery

By **KIRK JOHNSON**

DENVER — It has been one of the great murder mysteries of the garden: what is killing off the [honeybees](#)?

Since 2006, 20 to 40 percent of the bee colonies in the United States alone have suffered “colony collapse.” Suspected culprits ranged from pesticides to genetically modified food.

Now, a unique partnership — of military scientists and entomologists — appears to have achieved a major breakthrough: identifying a new suspect, or two.

A fungus tag-teaming with a virus have apparently interacted to cause the problem, according to a paper by Army scientists in Maryland and bee experts in Montana in [the online science journal PLoS One](#).

Exactly how that combination kills bees remains uncertain, the scientists said — a subject for the next round of research. But there are solid clues: both the virus and the fungus proliferate in cool, damp weather, and both do their dirty work in the bee gut, suggesting that insect nutrition is somehow compromised.

Liaisons between the military and academia are nothing new, of course. World War II, perhaps the most profound example, ended in an atomic strike on Japan in 1945 largely on the shoulders of scientist-soldiers in the Manhattan Project. And a group of scientists led by Jerry Bromenshenk of the University of Montana in Missoula has researched bee-related applications for the military in the past — developing, for example, a way to use [honeybees in detecting land mines](#).

But researchers on both sides say that colony collapse may be the first time that the defense machinery of the post-Sept. 11 [Homeland Security Department](#) and academia have teamed up to address a problem that both sides say they might never have solved on their own.

“Together we could look at things nobody else was looking at,” said Colin Henderson, an associate professor at the University of Montana’s College of Technology and a member of Dr. Bromenshenk’s “Bee Alert” team.

Human nature and bee nature were interconnected in how the puzzle pieces came together. Two brothers helped foster communication across disciplines. A chance meeting and a saved business card proved pivotal. Even learning how to mash dead bees for analysis — a skill not taught at [West Point](#) — became a factor.

One perverse twist of colony collapse that has compounded the difficulty of solving it is that the bees do not just die — they fly off in every direction from the hive, then die alone and dispersed. That makes large numbers of bee autopsies — and yes, entomologists actually do those — problematic.

Dr. Bromenshenk’s team at the University of Montana and Montana State University in Bozeman, working with the [Army’s Edgewood Chemical Biological Center](#) northeast of Baltimore, said in their jointly written paper that the virus-fungus one-two punch was found in every killed colony the group studied. Neither agent alone seems able to devastate; together, the research suggests, they are 100 percent fatal.

“It’s chicken and egg in a sense — we don’t know which came first,” Dr. Bromenshenk said of the virus-fungus combo — nor is it clear, he added, whether one malady weakens the bees enough to be finished off by the second, or whether they somehow compound the other’s destructive power. “They’re co-factors, that’s all we can say at the moment,” he said. “They’re both present in all these collapsed colonies.”

Research at the [University of California, San Francisco](#), had already identified the fungus as part of the problem. And several RNA-based viruses had been detected as well. But the Army/Montana team, using a new software system developed by the military for analyzing proteins, uncovered a new DNA-based virus, and established a linkage to the fungus, called *N. ceranae*.

“Our mission is to have detection capability to protect the people in the field from anything biological,” said Charles H. Wick, a microbiologist at Edgewood. Bees, Dr. Wick said, proved to be a perfect opportunity to see what the Army’s analytic software tool could do. “We brought it to bear on this bee question, which is how we field-tested it,” he said.

The Army software system — an advance itself in the growing field of protein research, or proteomics — is designed to test and identify biological agents in circumstances where commanders might have no idea what sort of threat they face. The system searches out the unique proteins in a sample, then identifies a virus or other microscopic life form based on the proteins it is known to contain. The power of that idea in military or bee defense is immense, researchers say, in that it allows them to use what they already know to find something they did not even know they were looking for.

But it took a family connection — through David Wick, Charles’s brother — to really connect the dots. When colony collapse became news a few years ago, Mr. Wick, a tech entrepreneur who moved to Montana in the 1990s for the outdoor lifestyle, saw a television interview with Dr. Bromenshenk about bees.

Mr. Wick knew of his brother’s work in Maryland, and remembered meeting Dr. Bromenshenk at a business conference. A retained business card and a telephone call put the Army and the Bee Alert team buzzing around the same blossom.

The first steps were awkward, partly because the Army lab was not used to testing bees, or more specifically, to extracting bee proteins. “I’m guessing it was January 2007, a meeting in Bethesda, we got a bag of bees and just started smashing them on the desk,” Charles Wick said. “It was very complicated.”

The process eventually was refined. A mortar and pestle worked better than the desktop, and a coffee grinder worked best of all for making good bee paste.

Scientists in the project emphasize that their conclusions are not the final word. The pattern, they say, seems clear, but more research is needed to determine, for example, how further outbreaks might be prevented, and how much environmental factors like heat, cold or drought might play a role.

They said that combination attacks in nature, like the virus and fungus involved in bee deaths, are quite common, and that one answer in protecting bee colonies might be to focus on the fungus — controllable with antifungal agents — especially when the virus is detected.

Still unsolved is what makes the bees fly off into the wild yonder at the point of death. One theory, Dr. Bromenshenk said, is that the viral-fungal combination disrupts memory or navigating skills and the bees simply get lost. Another possibility, he said, is a kind of insect insanity.

In any event, the university's bee operation itself proved vulnerable just last year, when nearly every bee disappeared over the course of the winter.